

# Principles of Chemistry II

Section 001, CRN#22410

# Chem 1220

MWF 8:30 – 9:20 am

Spring 2006

ESLC 130

**Professor John L. Hubbard**

**Office: Maeser Lab 361**

**Phone: 797-1641**

**Office Hours :** MW 2-3 pm, or by appointment

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**Text:** “Chemistry: The Central Science” 10<sup>th</sup> Edition, Brown, Lemay, Bursten

**Prerequisites:** Math 1050 or equivalent; Chem 1210 or equivalent

**Recitation:** You must be registered for a recitation section (CRN# 22411-22424). You will meet in recitation once each week to review material from the lectures. The "cycles" of recitation are designed to prepare everyone for the midterm exams. Since Midterm exams are offered on Wednesdays, no recitation sections meet on Wednesdays. Because of the Monday holidays in the Spring term (Jan 16, Feb 20), the cycles of recitations are a little complicated. Thus, I provide the detailed schedule (next page). A total of 11 cycles are offered and 10 graded quizzes will be recorded (for the first 10 weeks). **One sixth (1/6) of your Chem 1220 grade is based on your best 10 of 11 recorded quizzes.**

**Resource Room:** Times and locations of the “Resource Room” will be announced during the first week of the term. These sessions are available on a walk-in basis to all general chemistry students.

**Supplemental Instruction :** Times and locations for meeting with the S.I. leader Brittany Webb will be announced by the second week of class. Brittany will attend our class each day and is especially qualified to assist students. ([brittanwebb@cc.usu.edu](mailto:brittanwebb@cc.usu.edu))

**Grading:** A total of 600 points is possible in Chem 1220. Points are distributed as follows:

1 <sup>st</sup> Hour Exam (W, 2/8, 8:30 am, ESLC 130)	.....100 pts
2 <sup>nd</sup> Hour Exam (W, 3/8, 8:30 am, ESLC 130)	.....100 pts
3 <sup>rd</sup> Hour Exam (W, 4/12, 8:30 am, ESLC 130)	.....100 pts
Final Exam (Mon, 5/1, 7:30 am, ESLC 130)	.....200 pts
Recitation quizzes (best 10 of 12 offered)	.....100 pts
<b>Total</b>	<b>.....600 pts</b>

Tentative Letter grade brackets (brackets could be lowered- *will Not* be raised):

**A/A- 100-88%**      **B-/B/B+ 77-87%**      **C-/C/C+ 60-76%**      **D/D+ 50-59%**

Anyone missing one of the scheduled exams for legitimate reasons (written documentation from physician, parent, guardian, lawyer, judge, etc.) will be eligible to take the Comprehensive Make-up Exam, offered on Friday, April 21, by appointment with Dr. Hubbard. Make-up recitation quizzes will not be offered.

## **Course Objectives/ Goals (also see Detailed Learning Objectives List):**

Chemistry 1220 is designed to prepare students to understand and solve a large variety of quantitative situations important for chemical kinetics, equilibria, and thermodynamics. Within this context, problems related to acid/base reactions, pH, electrochemistry, and nuclear reactivity are addressed. Issues related to the Earth's environment are integrated into the coverage. Finally, a broad range of descriptive topics (the chemistry of metals, nonmetals, organic and biological substances) is presented to complete the course.

## **Course Provisions:**

The *Americans with Disabilities Act* mandates that reasonable accommodation will be made for students with disabilities in order to assure equal participation in Chem 1220. Students requesting such accommodation must meet with Dr. Hubbard during the first week of classes and must coordinate such accommodations with the Disabilities Resource Center.

The administration of Chem 1220 will adhere strictly to the academic regulations stipulated in the most recent Schedule of Classes and the USU General Catalog. Withdrawal from the course will follow official USU procedures.

## **WebCT**

I will be utilizing a WebCT management system for this section of Chem 1220. All registered students will have access to WebCT using the following process:

Using a web browser from any location go to: [webct.usu.edu](http://webct.usu.edu) . Then , Log on using your WebCT identity- This is simply your University Banner A-number ID. Your password is your Banner Password.

## **• Course Materials are on WebCT:**

*recommended problems/solutions, sample exams/exam keys, practice quizzes, etc*

*Your Exam results will be e-mailed privately to your cc.usu.edu e-mail account.*

## Detailed Schedule, Spring 2006

Day	Date	Lecture	Topic	Chapter	Comments
M	1/9	1	Reaction rates, Rates and stoichiometry	14	<b>First day of Lecture</b>
W	1/11	2	Concentration and rates- 1 <sup>st</sup> order, 2 <sup>nd</sup> order, ½ lives	14	<No Recitations Jan 9-13>
F	1/13	3	Temperature and rates	14	
M	1/16	-	<b>Martin Luther King Holiday</b>		<b>Recitation Cycle 1: Begins Tue, Jan 17 (Ch14)</b>
W	1/18	4	Reaction Mechanisms, Catalysis	14	
F	1/20	5	Equilibrium concepts	15	
M	1/23	6	Equilibrium constants, Keq values- calculation	15	<b>Recitation Cycle 2 Begins Tue, Jan 24 (Ch15)</b>
W	1/25	7	Applications, LeChatelier's Principle	15	
F	1/27	8	Bronsted Lowry, Autoionization of water	16	<Monday, Jan 30- Last day to add>
M	1/30	9	pH scale, strong acids, strong bases	16	<b>Recitation Cycle 3 Begins Tue, Jan 31 (Ch16)</b>
W	2/1	10	Weak acids, weak bases, Ka, Kb	16	
F	2/3	11	Acid/base properties of salts, Lewis acid/bases	16	
M	2/6	12	Review	14,15,16	
W	2/8	<b>EXAM 1</b>	<b>Chapters 14, 15, 16</b>	<b>EXAM 1</b>	<b>**No recitations Thurs Feb 9 or Fri Feb 10</b>
F	2/10	13	Common Ions, Buffers	17	
M	2/13	14	Acid-Base titrations, solubility equilibria	17	<b>Recitation Cycle 4 Begins Tue, Feb 14 (Ch17)</b>
W	2/15	15	Complex ions, amphoterism,	17	
F	2/17	16	Precipitation of ions	17	
M	2/20	-	<b>PRESIDENTS DAY HOLIDAY</b>	-	
<b>Tuesday</b>	2/21	17	Earth's atmosphere, photochemistry, Ozone	18	<b>**Note: we meet on Tuesday !!**</b>
W	2/22	18	Earth's oceans, freshwater, "green" chemistry	18	<b>Recitation Cycle 5 Begins Thurs, Feb 23 (Ch18)</b>
F	2/24	19	Spontaneous processes	19	
M	2/27	20	Entropy and 2 <sup>nd</sup> Law of thermodynamics	19	<b>Recitation Cycle 6 Begins Thurs, Mar 2 (Ch19)</b>
W	3/1	21	Entropy changes in reactions	19	
F	3/3	22	Gibb's Free energy, temperature relationships	20	
M	3/6	23	Review	17,18,19	<b>**No recitations Thurs Mar 9 or Fri Mar 10**</b>
W	3/8	<b>EXAM 2</b>	<b>Chapters 17, 18, 19</b>	<b>EXAM 2</b>	<Mar 9 Last day to Drop with a "W"/ or P/F change>
F	3/10	24	Oxidation/reduction reactions, balancing reactions	20	
M	3/13	-	<b>SPRING BREAK</b>	-	<b>SPRING BREAK</b>
W	3/15	-	<b>SPRING BREAK</b>	-	<b>SPRING BREAK</b>
F	3/17	-	<b>SPRING BREAK</b>	-	<b>SPRING BREAK</b>
M	3/20	25	EMF, Spontaneity of Redox reactions	20	<b>Recitation Cycle 7 Begins Mon, Mar 20 (Ch20)</b>
W	3/22	26	Concentration effects on EMF	20	
F	3/24	27	Chemical Batteries	20	
M	3/27	28	Corrosion, Electrolysis	20	<b>Recitation Cycle 8 Begins Mon, Mar 27 (Ch21)</b>
W	3/29	29	Radioactivity, patterns of nuclear stability	21	
F	3/31	30	Nuclear transmutations, rates of decay, detection	21	<Mar 31 Last day to drop with "W/grade" >
M	4/3	31	Energy change in nuclear reactions, bombs, reactors	21	<b>Recitation Cycle 9 Begins Mon, Apr 3 (Ch22)</b>
W	4/5	32	Hydrogen, Noble gases, halogens, Oxygen group	22	
F	4/7	33	Nitrogen group, carbon group, Boron group	22	
M	4/10	34	Review	20,21,22	<b>**No recitations Week of Apr 10-14**</b>
W	4/12	<b>EXAM 3</b>	<b>Chapters 20, 21, 22</b>	<b>EXAM 3</b>	
F	4/14	35	Purification of Al, Na, Fe, Cu	23	
M	4/17	36	Models of Metallic Bonding, metallic properties	23	<b>Recitation Cycle 10 Begins Mon, Apr 17 (Chap 23)</b>
W	4/19	37	Coordination complexes	24	
F	4/21	38	Color, Magnetism properties	24	Make-up Exam (by permission/appointment only)
M	4/24	39	Characteristics of organic molecules- functional groups	25	<b>Recitation Cycle 11 Begins Mon, Apr 24 (Chap 24)</b>
W	4/26	40	Carbonyls, introduction to peptide bonds, proteins	25	
F	4/28	41	Nucleic Acids, DNA	25	<b>Last Day of Lecture</b>
<b>MON</b>	5/1	<b>FINAL</b> 7:30 am	<b>Comprehensive Final Exam</b> <b>Chapters 14-25</b>	<b>FINAL</b> 7:30 am	

### Recitation "cycles"

**Week 1** (Tues 1/17- Mon 1/23)

**Week 2** (Tues 1/24- Mon 1/30)

**Week 3** (Tues 1/31 - Mon 2/6)

**No recitations Tues 2/7, Thurs 2/9, Fri 2/10, or Mon 2/13**

**Week 4** (Tues 2/14- Tues 2/21)

**Week 5** (Thur 2/23- Tue 2/28)

**Week 6** (Thur 3/3- Tue 3/7)

**No recitations Thurs 3/9 or Fri 3/10**

**<<<Spring Break 3/14 - 3/18>>>**

**Week 7** (Mon 3/20- Fri 3/24)

**Week 8** (Mon 3/27- Fri 3/31)

**Week 9** (Mon 4/3- Fri 4/7)

**No recitations Mon 4/10, Tues 4/11, Thurs 4/13, Fri 4/14**

**Week 10** (Mon 4/17- Fri 4/21)

**Week 11** (Mon 4/24- Fri 4/28)

### Coverage

Chapter 14

Chapter 15

Chapter 16

Chapter 17

Chapter 18

Chapter 19

Chapter 20

Chapter 21

Chapter 22

Chapter 23

Chapter 24,25

### Comments

*Cycle Begins on Tuesday, ends on the following Monday*

**(Exam 1 on Wed 2/8) Chapters 14, 15, 16**

**Note: Tues 2/22 is a Monday Schedule**

*Cycle Now Begins on Thurs, ends the following Tues*

**(Exam 2 on Wed 3/8) Chapters 17, 18, 19**

*Cycle Now Begins on Monday, ends on Friday*

**(Exam 3 on Wed 4/12) Chapters 20, 21, 22**

**(Final Exam on Mon, 5/1)**

**Chapters 14-25**

**7:30 am ESLC 130**

## Chem 1220 Detailed Learning objectives:

Describe reaction rates in terms of zero, 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> order processes

Describe reaction rates as a function of temperature

Predict reaction half-lives given initial conditions

Differentiate between the plots of 1<sup>st</sup> order and 2<sup>nd</sup> order reactions

Describe the action of catalysis on a chemical reaction

Describe reactions in terms of elementary steps and rate-determining steps

Write equilibrium constant expressions

Perform calculations of concentrations, pressures using  $K_{eq}$  information

Predict the direction of a reaction using the reaction quotient

Explain Le Chatelier's Principle

Cite essential definitions of acids and bases

Utilize the autoionization of water to define pH and pOH,  $K_w$ ,  $pK_w$

Employ  $K_a$ ,  $K_b$  values to calculate pH, pOH of solutions of weak acids, weak bases, and salts

Describe chemical factors that contribute to the strength of acids and bases

Apply concepts of the Common Ion effect to design and construct acid/base buffer systems

Calculate acid/base titration curves and predict end-point conditions

Describe and apply  $K_{sp}$  values to determine solubility of inorganic solids

Describe the precipitation and separation of ions utilizing  $K_{sp}$  information

Describe the chemical composition of the Earth's crust, atmosphere, and surface waters

Describe chemical reactions in the atmosphere caused by solar radiation

Describe chemical reactions related to acid rain

Describe and apply concepts of chemical spontaneity and the 2<sup>nd</sup> Law of Thermodynamics

Describe and apply the concepts of entropy to chemical reactions

Use Gibb's Free Energy to predict chemical equilibrium

Balance chemical reactions that involve changes in oxidation states

Express oxidation/reduction in terms of half reactions

Describe voltaic cells and calculate potentials using standard reduction potentials

Predict the spontaneity of oxidation/reduction reactions

Employ the Nernst Equation to calculate cell potentials and chemical concentrations

Describe the essential reactions related to common battery systems and fuel cells in use today

Describe the chemical reactions of corrosion

Describe and differentiate between fundamental types of radioactivity and radioactive processes

Predict nuclear stability based on proton/neutron ratios

Apply 1<sup>st</sup> order kinetics for radioactive decay

Compare the energetic and mass aspects of nuclear fission and nuclear fusion

Describe the fundamental aspects of the reactivity of non-metal elements

Identify the major chemical processes for purifying iron, steel, aluminum, copper, and sodium

Describe the structure and bonding in simple coordination complexes of transition metals like Fe, Cu

Predict simple electronic configurations for transition metal ions using the periodic table

Predict magnetism using simple models of Crystal Field Theory

Discuss how the color of transition metal complexes is related to d-orbital splitting

Identify and draw the structure of hydrocarbon alkanes, alkenes, alkynes, and aromatics

Identify and draw the organic functional groups ethers, aldehydes, ketones, acids, esters, and amides

Identify the chemical structure of amino acids and polypeptides

Identify the chemical structure of carbohydrate sugars and fats

Identify the chemical structure of nucleic acids and DNA, RNA